



# The Next Stage in Evaporative Cooling

PIER Buildings Program

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## The Problem

Evaporative coolers in residential applications save energy compared with conventional vapor-compression air conditioners. However, traditional evaporative units must move large quantities of air to achieve adequate cooling. Moving all that air generates a lot of noise and leads to the need to directly exhaust that air. In many cases, exhaust is accomplished simply by opening windows, which can introduce wind-borne dust and raise security concerns.

## The Solution

A new 3-ton equivalent evaporative cooler called the OASys (**Figure 1**) addresses these problems by using both direct and indirect evaporative cooling. This two-pronged approach produces a greater temperature drop, thereby reducing the volume of air required. The OASys also uses less energy than conventional evaporative coolers. The system was developed by the Davis Energy Group, an HVAC consulting company,

and will be manufactured by Speakman CRS, a manufacturer of clean and sustainable technologies.

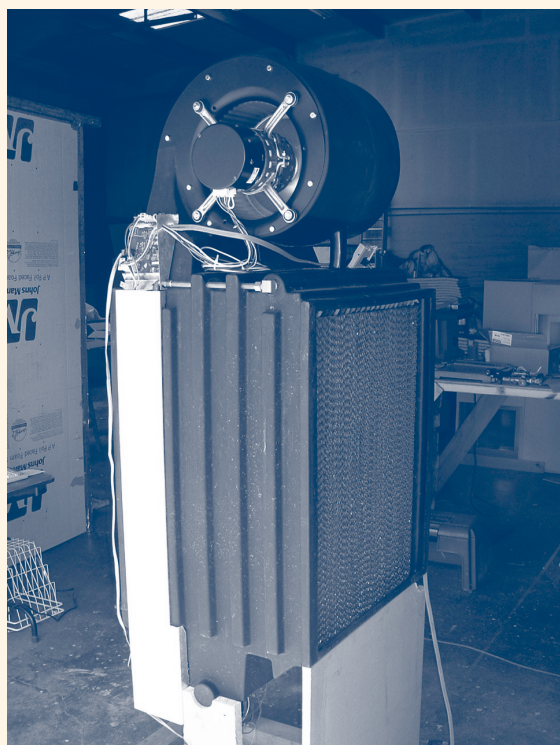
## Features and Benefits

The OASys packages heat exchangers and airflow paths in a unique way, providing energy-efficient operation as well as improved comfort.

**Energy and demand savings.** The OASys features an efficient new counter-flow heat exchanger, an energy-efficient electronically commutated motor, and an innovative routing of air within the unit that effectively adds a third stage to the cooling process (**Figure 2**). This results in an annual energy savings of 89 to 95 percent and demand savings of 80 to 90 percent compared with vapor-compression air conditioners.

Turning to seasonal energy-efficiency ratios (SEER), the California *Appliance Efficiency Regulations* established a minimum SEER of 9.7 for vapor-compression single-package units. The OASys offers a SEER of better than 40, which compares quite favorably. However, this rating is limited as a measure of efficiency improvement, because the OASys was tested under different conditions than the Air Conditioning and Refrigeration Institute uses for testing conventional air conditioners.

**Figure 1: A cooling OASys**  
This is an assembled OASys test unit.



**Figure 2: OASys airflow patterns**  
The OASys uses both direct and indirect evaporative cooling.

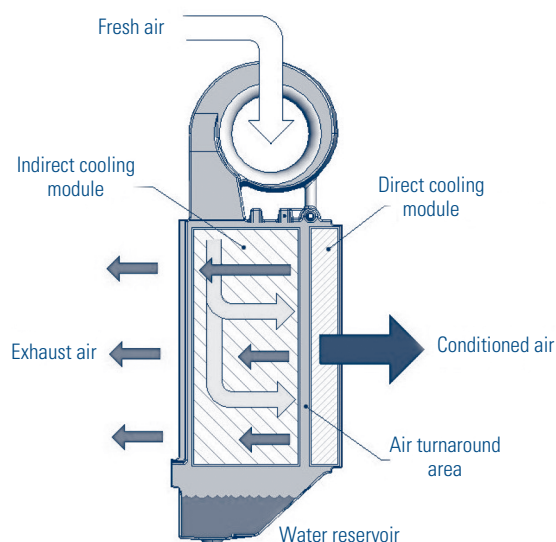


Table 1: OASys introduces less humidity

As the data for two different climates show, by cooling outdoor air with an indirect evaporative stage, the OASys would bring less moisture into a building than a comparable conventional evaporative cooler would.

	Sacramento	Denver
Indoor temperature (F)	78	78
Outdoor drybulb temperature (F)	100	93
Outdoor wetbulb temperature (F)	70	60
Indoor relative humidity with OASys (%)	60	37
Indoor relative humidity with a conventional evaporative cooler (%)	70	47

Note: F = Fahrenheit.

**Reduces the need to open windows.** Although the OASys still requires the use of dedicated exhausts, the reduction in airflow makes it easier to rely on passive pressure-release exhaust vents that can be mounted in the ceiling, eliminating the need to open windows.

**Introduces less humidity.** The OASys cools outdoor air in an indirect evaporative stage before sending it through a direct evaporative stage. Therefore, the system introduces less moisture into a building than a conventional single-stage direct evaporative cooler (Table 1).

**Resists corrosion.** Unlike traditional evaporative coolers, the OASys uses a molded plastic cabinet that is resistant to corrosion.

**Offers competitive cost.** With an uninstalled cost of around \$2,500, the OASys will be competitive with comparable air conditioners. This should lead to an immediate payback in regions where evaporative cooling cuts energy consumption.

## Applications

The OASys is suitable for residential applications in hot and dry climates, which includes many parts of the U.S. southwest and mountain states. Applications where indoor air quality is especially important, such as modular classrooms, are also good candidates for this technology.

## California Codes and Standards

Under the present standards, either direct or indirect/direct evaporative coolers may be used, subject to the eligibility and installation criteria cited in the current "Alternative Calculation Method (ACM) Manual." Credits assume 11 SEER for a direct system and 13 SEER for an indirect/direct system, with either type of system using R4.2 to R8 ducts in the attic, depending on climate zone. Increased credits in future standards would encourage wider use of evaporative cooling.

## What's Next

Field testing is currently under way, with 20 units installed in California, Utah, Colorado, and Arizona. Another 25 units will be available for testing by late in the 2005 cooling season. Speakman CRS anticipates going into full production with the OASys in late 2005 or early 2006. Future products may combine the OASys with a heating element or a small vapor-compression air conditioner to enable use of the two-stage evaporative technology in a broader range of conditions.

## Collaborators

The organizations currently involved with this project are the Davis Energy Group and Speakman CRS. Additional funding for this project was provided by Sacramento Municipal Utility District.

## For More Information

Detailed reports on this project are available online at [www.energy.ca.gov/pier/buildings/projects/500-98-022-0.html](http://www.energy.ca.gov/pier/buildings/projects/500-98-022-0.html).

To view Technical Briefs on other topics, visit [www.esource.com/public/products/cec\\_form.asp](http://www.esource.com/public/products/cec_form.asp).

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## About PIER

This project was conducted by the California Energy Commission's Public Interest Energy Research (PIER) program. PIER supports public-interest energy research and development that helps improve the quality of life in California by bringing environmentally safe, affordable, and reliable energy services and products to the marketplace.

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